A Case Study to Examine Technical Data Relationships to the System Model Concept

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DASD, Systems Engineering Mission

Systems Engineering focuses on engineering excellence − the creative application of scientific principles:

– To design, develop, construct and operate complex systems

– To forecast their behavior under specific operating conditions

– To deliver their intended function while addressing economic efficiency, environmental stewardship and safety of life and property

DASD(SE) Mission: Develop and grow the Systems Engineering capability of the Department of Defense – through engineering policy, continuous engagement with component Systems Engineering organizations and through substantive technical engagement throughout the acquisition life cycle with major and selected acquisition programs.

A Robust Systems Engineering Capability Across the Department Requires Attention to Policy, People and Practice

- *US Department of Defense is the World's Largest Engineering Organization*

- *Over 99,000 Uniformed and Civilian Engineers*

- *Over 39,000 in the Engineering (ENG) Acquisition Workforce*

DASD, Systems Engineering

DASD, Systems Engineering
Stephen Welby
Principal Deputy Kristen Baldwin

Systems Analysis
Kristen Baldwin (Acting)

Addressing Emerging Challenges on the Frontiers of Systems Engineering

Analysis of Complex Systems/Systems of Systems

Program Protection/Acquisition Cyber Security

University, FFRDC and Industry Engineering and Research

Modeling and Simulation

Major Program Support
James Thompson

Supporting USD(AT&L) Decisions with Independent Engineering Expertise

Engineering Assessment / Mentoring of Major Defense Programs

Program Support Reviews

OIPT / DAB / ITAB Support

Systems Engineering Plans

Systemic Root Cause Analysis

Mission Assurance
Vacant

Leading Systems Engineering Practice in DoD and Industry

Systems Engineering Policy & Guidance

Development Planning/Early SE

Specialty Engineering (System Safety, Reliability and Maintainability Engineering, Quality, Manufacturing, Producibility, Human Systems Integration)

Counterfeit Prevention

Technical Workforce Development

Standardization

Providing technical support and systems engineering leadership and oversight to USD(AT&L) in support of planned and ongoing acquisition programs

Purpose

- **The system model will integrate (a TBD subset of) program data into a complete description of the system.**

ISSUE: Current DoD acquisition activities do not develop, or maintain a single, integrated authority/artifact (aka system model) for a TBD subset of program data. Further, relevant data between acquisition activities is not adequately shared.

VISION: Use of a single model (aka system model) as an evolving, cohesive representation and unifying instantiation of the program under conceptualization, development, manufacture, and/or support:
- will increase efficiency of DoD system acquisition lifecycle activities, and
- increase confidence in decisions made regarding an acquisition program when the single (system) model (data) for that program is used.
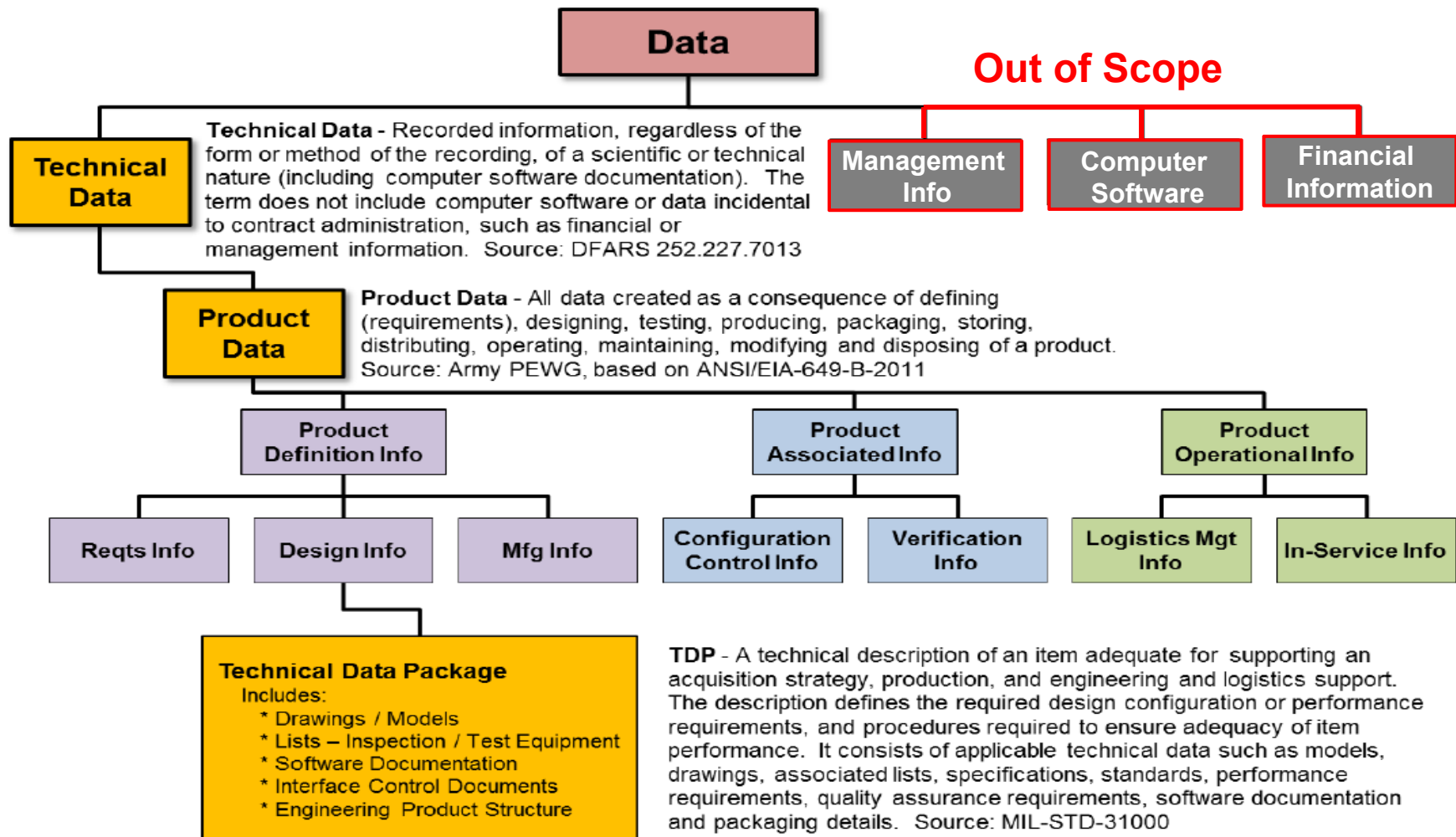
METHOD: A system model will be instantiated by using artifacts and processes which already exist, or are already required by DoD acquisition policies, guidance, and best practices.

OUTCOME: It is a framework for "technical communication". The system model will be used by anyone performing activities related to the program as it evolves across the acquisition lifecycle, including but not limited to defining requirements, trading design aspects, designing, engineering, cost budgeting, staffing, manufacturing, fielding, training, sustaining, and disposing. The resultant system model will integrate program data into a complete description of the system.

- **Case Study Purpose**
  - Examine the technical data acquired by three major programs
  - Examine the challenges associated with integrating technical data to support the system model concept

Technical Data

Data

Out of Scope

Technical Data

Technical Data - Recorded information, regardless of the form or method of the recording, of a scientific or technical nature (including computer software documentation). The term does not include computer software or data incidental to contract administration, such as financial or management information. Source: DFARS 252.227.7013

Management Info	Computer Software	Financial Information

Product Data

Product Data - All data created as a consequence of defining (requirements), designing, testing, producing, packaging, storing, distributing, operating, maintaining, modifying and disposing of a product. Source: Army PEWG, based on ANSI/EIA-649-B-2011

Product Definition Info

Product Associated Info

Product Operational Info

Reqts Info	Design Info	Mfg Info	Configuration Control Info	Verification Info	Logistics Mgt Info	In-Service Info

Technical Data Package
Includes:
* Drawings / Models
* Lists – Inspection / Test Equipment
* Software Documentation
* Interface Control Documents
* Engineering Product Structure

TDP - A technical description of an item adequate for supporting an acquisition strategy, production, and engineering and logistics support. The description defines the required design configuration or performance requirements, and procedures required to ensure adequacy of item performance. It consists of applicable technical data such as models, drawings, associated lists, specifications, standards, performance requirements, quality assurance requirements, software documentation and packaging details. Source: MIL-STD-31000

Source: DAG Chapter 4

Defining Data Needs
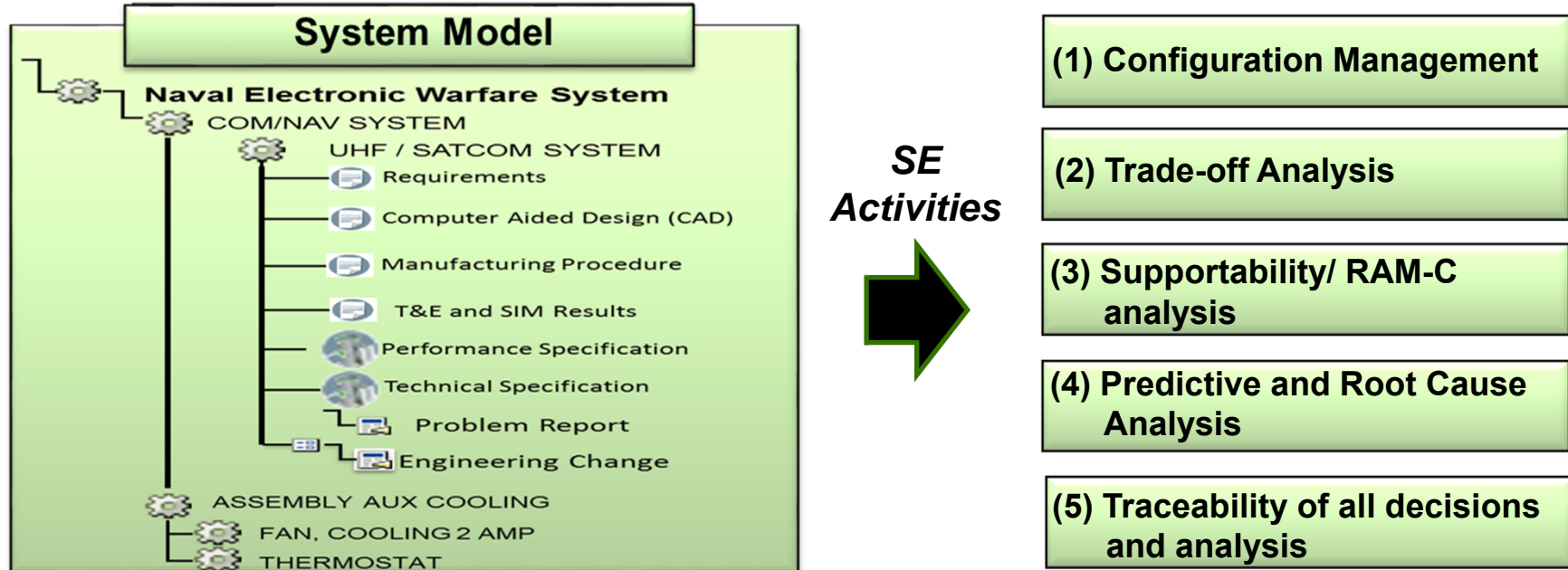
Sample CDRL

- **Contract Data Requirements List (CDRL) (DD Form 1423)**
  - Defines contractor data requirements
    - Based on tasks defined in the Statement of Work (SOW)
  - A separate CDRL is required for each type or class of data being delivered.
  - Each CDRL references a Data Item Description (DIDs)
    - Defines the content and format requirements for data requirements

Case Study Overview

- **DASD(SE) collaboration with**
  - Communications- Electronic Command Logistics and Readiness Center (CECOM LRC)
  - Naval Surface Warfare Center Port Hueneme Division (NSWC PHD)

- **Integrated, managed, and assimilated technical data into a system model for specific SE activities**

System Model

Naval Electronic Warfare System
- COM/NAV SYSTEM
  - UHF / SATCOM SYSTEM
    - Requirements
    - Computer Aided Design (CAD)
    - Manufacturing Procedure
    - T&E and SIM Results
    - Performance Specification
    - Technical Specification
    - Problem Report
    - Engineering Change
- ASSEMBLY AUX COOLING
  - FAN, COOLING 2 AMP
  - THERMOSTAT

SE Activities

(1) Configuration Management

(2) Trade-off Analysis

(3) Supportability/ RAM-C analysis

(4) Predictive and Root Cause Analysis

(5) Traceability of all decisions and analysis

Case Study Approach

- **Leveraged the system model effort to understand technical data relationships to the system model concept**
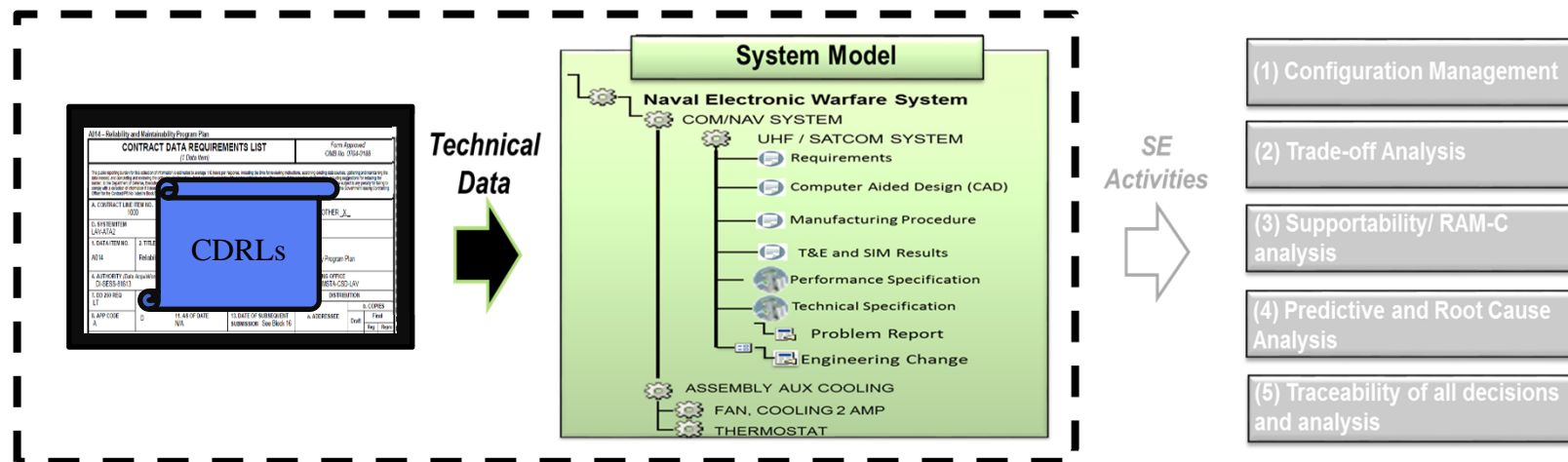
- **Case Study Approach**

  - Identified minimum data requirements to enable system model concept

  - Baselined data procured via contracts

  - Reconciled and integrated data from CDRLs

  - Utilized integrated COTS product lifecycle management technologies

  - Examined challenges

Overview of Case Study Programs

- **Three programs pre-Milestone C**

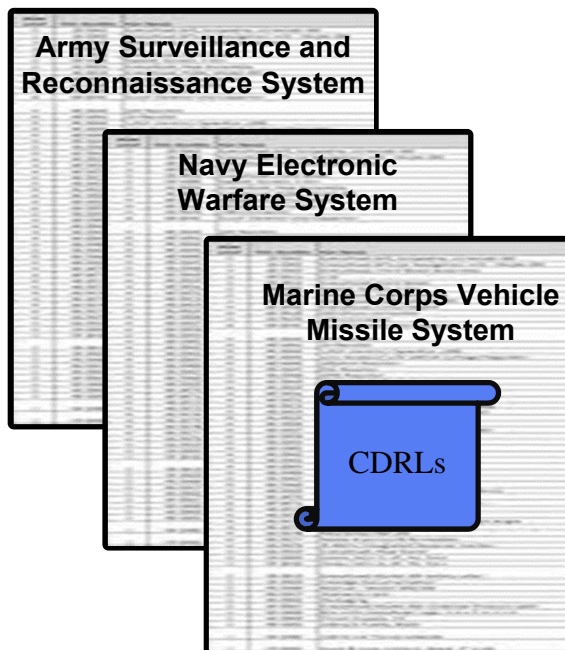| Navy Electronic Warfare System	Army Surveillance and Reconnaissance System	Marine Corps Vehicle Missile System

- **These programs were selected based on**
  - CECOM LRC and NSWC PHD collaboration to manage program technical data and use system model development
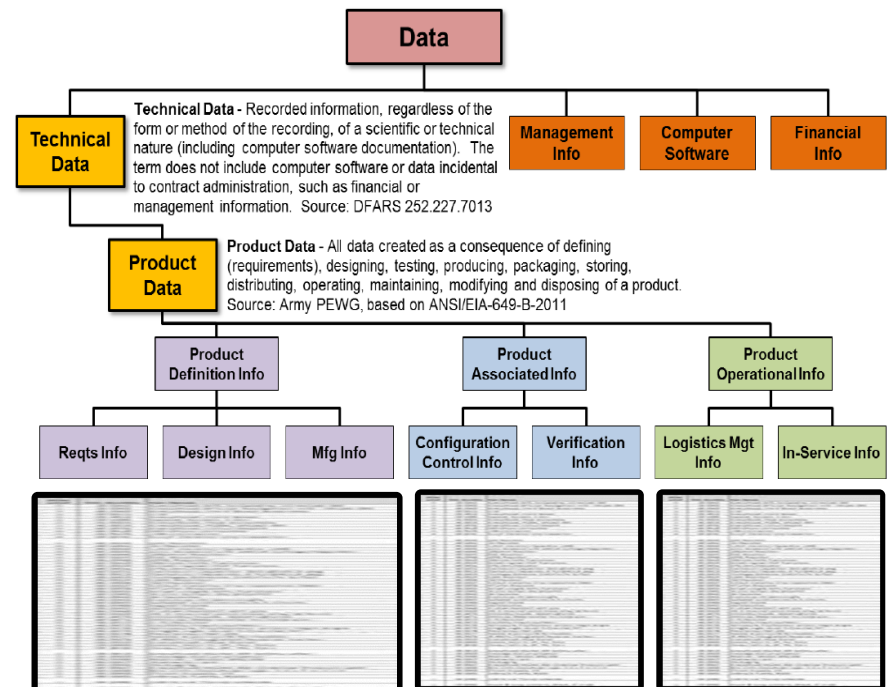 - Availability of and access to technical data

Programs CDRLs/Technical Data

Captured CDRL technical data for each program

Army Surveillance and Reconnaissance System

Navy Electronic Warfare System

Marine Corps Vehicle Missile System

CDRLs

Mapped CDRL technical data to Data Taxonomy

Data

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Technical Data

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Product Data

Product Definition Info

Product Associated Info

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Reqts Info

Design Info

Mfg Info

Configuration Control Info

Verification Info

Logistics Mgt Info

In-Service Info

Identified technical data acquired by the programs

Need to further define what data are needed at what phase to support what analysis/activity.

Overarching Findings

- **Incomplete understanding of the data's intended use**

- **Lacked data validation and use of data to perform analysis**

- **The information within the technical data deliverables were not integrated**

- **Inconsistencies found in the data because information is maintained in different systems and managed by different teams**

- **Decisions and tradeoffs were not traceable to the technical data**

- **Information was not timely—decisions were already made**

Conclusion

- **Gov't did have access to needed data**

- **Challenges primarily in integrating and using the data in a timely fashion to support decisions**

- **Required an integrated technology environment**

- **Future Work**

  - Expand scope to define what technical data are needed throughout the lifecycle

  - Further refine the system model definition
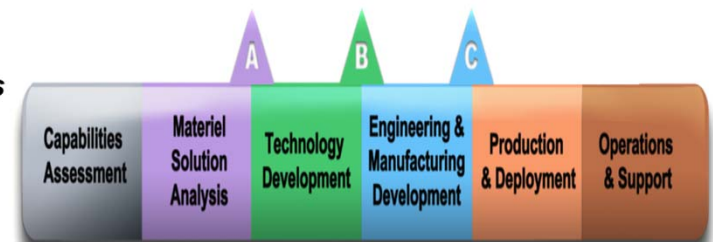
 - Identify a pilot program to test the "system model"

Product Data Interactive Tool

- **The Product Data Interactive Tool was developed by CECOM LRC to help programs determine technical data needs**

- **Functional capabilities in work**
  - **User friendly Microsoft Access Application**
  - **Identifies technical data and data rights of DIDs**
  - **Identifies data needed to support milestone requirements, technical reviews, and key events**
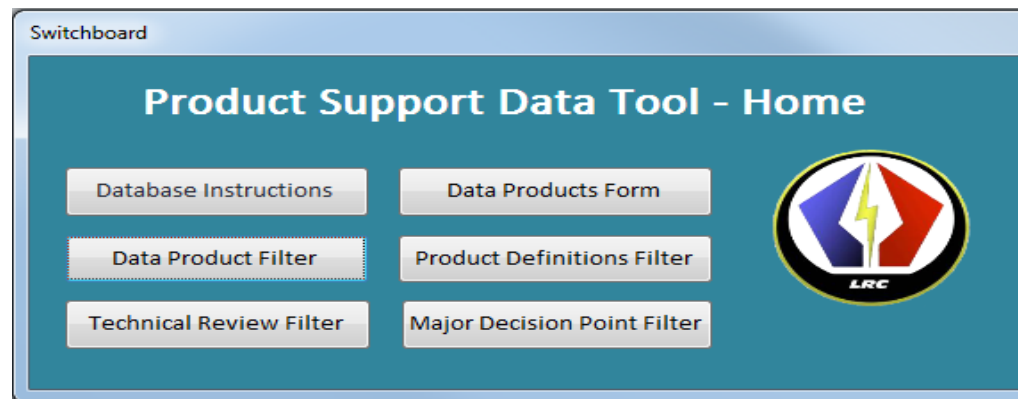
References

- **Defense Acquisition Guide**

- **DoD 5010.12-M, "Procedures for the Acquisition and Management of Technical Data"**

- **DoDI 1070 5000.02, "Operation of the Defense Acquisition System"**

- **Technology Development Strategy/Acquisition Strategy**

- **Technical Data Rights Strategy (2012 Army Guide)**

For Additional Information

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Product Data Tool

Case Study Programs

Technical Data Rights

System Model

Systems Engineering:
Critical to Defense Acquisition

Innovation, Speed, Agility
http://www.acq.osd.mil/se